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# Rhyzopertha

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*Rhyzopertha* is a monotypic genus of beetles in the family Bostrichidae, the false powderpost beetles. The sole species, *Rhyzopertha dominica*, is known commonly as the lesser grain borer, American wheat weevil, Australian wheat weevil, and stored grain borer.<sup>[3]</sup> It is a beetle commonly found within store bought products and pest of stored cereal grains located worldwide.<sup>[4]</sup> It is also a major pest of peanuts. The first documentation of wheat infestation by *R. dominica* was observed in Australia.<sup>[4]</sup> *R. dominica* are usually reddish brown to dark brown in coloration, vary in sizes, elongated and cylindrical.<sup>[4]</sup>

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## Identification [[edit source](#)]

The average *R. dominica* are 2.1 - 3.0 mm in length.<sup>[1]</sup> Their body displays a reddish brown coloration with 11 antennae segments and a 3-segmented antennal club.<sup>[1]</sup> The pronotum is located near the base of the body with no depressions.<sup>[1]</sup> In addition, the basal part of the **pronotum** has a wrinkled appearance.<sup>[1]</sup> Distinct tubercles on the *R. dominica* are found on the anterior margin, but appear to be slightly apart at the median.<sup>[1]</sup> Moreover, it has clear elytral striae that are angularly rounded at the apex, and short, yellowish, bent setae.<sup>[1]</sup> Externally there are no major recognizable differences between male and female adults of *R. dominica*.<sup>[1]</sup>

## Distribution and Diversity [[edit source](#)]

The geographical origin of *R. dominica* is still uncertain, however the scientific community has agreed that the Indian subcontinent is its most probable native home, as the region is inhabited by other bostrichid species.<sup>[4]</sup> Currently, *R. dominica* has a worldwide distribution, especially in warmer temperate climates zones, between latitude 40° North and South from the equator.<sup>[4]</sup> It is predominantly found in forested and grain storage environments.<sup>[4]</sup> As such, human interaction has aided in the wide spread of *R. dominica* through the commercial transportation of grain.<sup>[4]</sup> A testament to their inhabitation of grain is the acquisition of the name “Australian Wheat Weevil”, symbolizing their predominant infestation of wheat in [Australia](#).<sup>[4]</sup>

## Taxonomy [[edit source](#)]

*R. dominica* is from the family Bostrichidae, commonly referred to as auger or powderpost beetles.<sup>[4]</sup> Currently the family consists of 550 bostrichid species, of which 77 of them are found in North America.<sup>[4]</sup> Bostrichids can be distinguished from other beetles due to their rasp-like pronotum, 5-segmented tarsi and straight antennae with 3-3 segments.<sup>[4]</sup> The genus Rhyzopertha is monotypic, consisting of only *R. dominica*. Further classification of this genus places it within the subfamily Dinortheinae.<sup>[4]</sup>

Diet [ [edit source](#) ]

There are various substrates that make up the resources and diet for the *R. dominica*.<sup>[4]</sup> This includes grains, such as **rice**, **wheat**, **sorghum**, oat, pearl, **millet**, malt barley from the family Poaceae, and chickpeas, peanuts and beans from the family Leguminosae.<sup>[4]</sup> *R. dominica* seems to be preadapted for feeding on dry grains.<sup>[4]</sup> It feeds on the whole grain in both larval and adult stages.<sup>[4]</sup>

## Courtship Behaviour and Reproduction [\[edit source\]](#)

*R. dominica* follows a 4-stage life cycle: egg, larval, pupal, and adult.<sup>[4]</sup> The mating behaviour in the *R. dominica* follows within 24 hour after the individual hatches from the egg.<sup>[4]</sup> The females do not display any courtship behavior such as initiation of mating or attempt to attract male beetles.<sup>[4]</sup> In some instances, the males will attempt to mate with other males, whereas this type of interaction is absent in females.<sup>[4]</sup> Female attraction to the male occurs upon physical contact, whereby the close proximity allows for the olfactory senses to detect the male produced pheromones.<sup>[4]</sup> The pheromones are also responsible for the attraction between male beetles.<sup>[4]</sup> Stimulation from the pheromones is characterized (in both male-to-male and male-to-female interaction) by an excited and rapid walking motion; the head, thorax, and antennae are extended forward and up, in the direction of the pheromone source.<sup>[4]</sup> When they are around a pheromone source, the beetles walk around with their antennae extended and they actively palpate the abdominal area.<sup>[4]</sup> The males will initiate a palp mediated mating response and mount the beetle if it were a female.<sup>[4]</sup> This occurs after he touches his maxillary palp to the tips of her elytra.<sup>[4]</sup> While mounting the female, the male moves to the posterior dorsal surface.<sup>[4]</sup> The male walks forward and taps lightly on top of the female's elytra and thorax with his palpi.<sup>[4]</sup> Contact with the vagina is made when the last sternite of the male beetle is lowered and the aedeagus protrudes to the vagina.<sup>[4]</sup> Once the male is firmly mounted, copulation has been achieved.<sup>[4]</sup> Copulation lasts for 2 hours and can occur multiple times in *R. dominica*, as females require more than one mating to fertilize effectively all the eggs produced during her lifetime.<sup>[4]</sup> Externally there are no major recognizable differences between male and female adults of *R. dominica*.<sup>[4]</sup> A reported minor difference is the last ventral abdominal sternite of the female, seen as pale yellow as compared to the uniformly brown males.<sup>[4]</sup>

## Infestation [[edit source](#)]

Maximum reproductive success is achieved on dry grains, such as wheat, explaining the infestation issue it causes from residual insect populations in grain storages and immigration from outside.<sup>[4]</sup> These products, which are stored in bulk, are understood to be human created ecosystems with a stable microclimate suitable to fit the pest's needs.<sup>[5]</sup> These ecosystems allow females to deposit their eggs loosely within the grain mass and allows the first larva to enter the kernel.<sup>[6][7]</sup> The larva after undergoing 4 larval instar development, will emerge from the kernel as an adult.<sup>[8]</sup> The duration of development takes up to 35 days, with optimal conditions of 28 °C and 50% humidity.<sup>[7]</sup> Once it reaches adulthood, they have difficulty moving on flat and smooth surfaces, due to reduced friction, and as a result are unable to access food.<sup>[9]</sup> Therefore, the grain mass is the most suitable for them due to their diet of grain based products, which can facilitate the appearance of more fungi and pests.<sup>[10]</sup> At the adult life stage, *R. dominica* flies to the surface of the grain mass and slowly works its way downward through the grain mass as far as 12m, further than other grain beetles.<sup>[4]</sup> Together with the deep movement into the grain mass and the cryptic feeding on the kernels, it can become difficult to detect initial *R. dominica* infestation.<sup>[4]</sup> Over time, because of *R. dominica* infestation, a sweetish odor is left within the infested grain as a result of the aggregation pheromones produced by males.<sup>[4]</sup> A large amount of frass is also produced from adult feeding activities, containing ovoid granules of undigested endosperm mixed with a finer flour, larvae exuviae, feces, fragments of immature insects, and various by products affecting the overall quality of the grain.<sup>[4]</sup> Adult and larval stages of *R. dominica* feed on the germ and endosperm. This degree of feeding can vary with the age of the beetles, with the highest amount of feeding done by young adult beetles.<sup>[4]</sup>

## Natural Enemies [[edit source](#)]

Various predaceous organisms are capable of coexisting with *R. dominica*, such as mites, bugs, and parasitoids that are also found infesting stored grain.<sup>[4]</sup> Two hemipterans, found in the family Anthrenoridae, four mites from the families Acarophenacidae, Pediculoidae, and Cheyletidae have all found to attack *R. dominica* within the storage, including five parasitoids from the families Bethyliidae and Pteromalidae.<sup>[4]</sup> All of these predators attacked the eggs or larval stage rather than the adult or pupal stage.<sup>[4]</sup> Mortality of *R. dominica* can also occur because of nematodes, fungi, protozoans and bacteria, acting as predators, while harming the larval and adult stages.<sup>[4]</sup>

Flight [\[ edit source \]](#)

The flight capacity of *R. dominica* has not been researched thoroughly, however, *R. dominica* is capable of flight.<sup>[4]</sup> This, aside from human intervention, permits their widespread spatial distribution between isolated resources.<sup>[4]</sup> They boast an impressive flying capacity as it has been observed to fly over 5 km from an infested location. Moreover, winds and wind drift can substantially assist in dispersal.<sup>[4]</sup> The attraction to pheromones can additionally aid them to fly upwind to the pheromone sources, possibly stimulated by pheromone molecules, without which dispersal is reduced.<sup>[4]</sup>

Control [ [edit source](#) ]

## Physical [\[ edit source \]](#)

Commercial and agricultural methods are being implemented to manage infestation and pest control of *R. dominica*.<sup>[4]</sup> Approaches includes minimizing pest migration and build-up within grain storage areas, through thorough cleaning of the equipment before harvest, sealing storage, spraying bins and units, and cleaning up any grain spills.<sup>[4]</sup> Close monitoring of the temperature in storage areas is a crucial step of managing, as it can influence the insect population.<sup>[4]</sup> Harvested wheat temperatures ranging from 27 °C to 34 °C degrees is optimal for insect reproduction and growth.<sup>[4]</sup> *R. dominica* are more vulnerable to the cold than other grain pests.<sup>[4]</sup> Temperatures below 15 °C are unfavourable for *R. dominica* to maintain their bodily activities.<sup>[4]</sup> To compensate, they become dormant, but this greatly increases their susceptibility to death at temperatures of 2 °C or lower.<sup>[4]</sup> Thus, aeration or grain drying, where grain is mechanically ventilated, can also be used to manage infestation through the maintenance of low temperatures in storage areas.<sup>[4]</sup> Unfortunately, *R. dominica* cannot be completely controlled solely with aeration. Although it is recommended for quality of grains, feasible and effective in reducing insect growth rate, damage from fungi and moisture.<sup>[4]</sup>

## Biological [[edit source](#)]

Predation by natural enemies of *R. dominica*, arthropod species, are insufficient methods of biological control due to their low numbers as compared to fecundity of *R. dominica*.<sup>[4]</sup> Moreover, the natural predators and parasitoids can fall prey themselves to other types of organisms, which is quite disadvantageous.<sup>[4]</sup> This in tandem with their deep burrowing feature, which allows them to successfully escape predation and risk, allows for effective *R. dominica* proliferation.<sup>[4]</sup>






## Chemical [ [edit source](#) ]

Insecticide grain protectants worldwide are also ineffective for *R. dominica* management. Many of these protectants are either not effective or the pest has grown resistance to them.<sup>[4]</sup> The protectant include organophosphorus insecticides such as chlorpyrifos methyl, fenitrothion, pirimiphos methyl and malathion.<sup>[4]</sup> When infestations become severe, fumigation is a suggested form of control.<sup>[4]</sup> The fumigant phosphine is key to controlling *R. dominica* since it targets all insect life stages, is easy to utilize, effective, feasible, and is a residue-free tactic.<sup>[4]</sup> Unfortunately, due to active dispersal, *R. dominica* has distributed resistance genes to certain fumigants and insecticides.<sup>[11]</sup> Other alternatives such as the use of ozone as a fumigant is also being tested on immature stages, larvae or pupae, which are more prone to being effected as compared to adults.<sup>[12]</sup> Aside from the evolution of resistance, the internal feeding technique of *R. dominica* confers protection from potential insecticides by creating safe spaces and shelter within the grain mass.<sup>[13]</sup> Further studies suggest that fumigants are not the only method of detecting and pest management implemented in the grain industry.<sup>[4]</sup> Research shows that soft x-ray methods are also being used to identify potential infested wheat kernels.<sup>[14]</sup> Despite, all efforts to manage *R. dominica*, they remain a detrimental pest in the production of wheat, rice and pasta<sup>[14]</sup>

Gallery [\[ edit source \]](#)



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## External links  [ [edit source](#) ]

- Home stored product entomology
- Bugguide.net page on the lesser grain borer: <https://bugguide.net/node/view/242035>
- *Rhyzopertha* Fauna Europaea.

<b>Taxon identifiers</b>	<p>Wikidata: <a href="#">Q659111</a>  · Wikispecies: <a href="#">Rhyzopertha</a>  · BioLib: <a href="#">9784</a>  · BOLD: <a href="#">388083</a>  · BugGuide: <a href="#">242034</a>  · EoL: <a href="#">39648</a>  · EPPO: <a href="#">1RH1TG</a>  · Fauna Europaea: <a href="#">101036</a>  · Fauna Europaea (new): <a href="#">f92fa230-389c-48b8-8481-dafe157ed20b</a>  · GBIF: <a href="#">1095715</a>  · iNaturalist: <a href="#">81958</a>  · IRMNG: <a href="#">1200850</a>  · ITIS: <a href="#">187463</a>  · NBN: <a href="#">NHMSYS0001720009</a>  · NCBI: <a href="#">92691</a>  · NZOR: <a href="#">f1246085-4a90-46b3-bd4a-5a59e0727946</a> </p>
<p>Categories: <a href="#">Bostrichidae</a>   <a href="#">Monotypic Bostrichiformia genera</a>   <a href="#">Agricultural pest insects</a>   <a href="#">Beetles described in 1792</a></p>	

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